Improving Medical Performance

(Six Sigma Anatomy & physiology)

Lecture 7

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Intended Learning Outputs :

By the end of this session, participants should be able to:

- Identify & recognize the Anatomy of Six Sigma " Body of Knowledge "
- Identify the Project Selection Criteria
- Identify & analyze The Standard Deviation
- Identify & recognize The Causes of Variation

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Introduction

Six Sigma is for those healthcare organization managers who believe that eliminating defects & errors is good for patients, community and for management & employees alike.

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Definition

Six Sigma is a management method that moves the organization in an orderly way from its present error rate to a very low one , with the specific target being 3.4 errors per million opportunities .

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- 7 % of hospitals inpatients are victims of drug-related errors alone, with average cost of care of $ 5,000 per case and the total cost of errors in healthcare is more than 10 % of the total system cost .

- SS can help as it is a method that is acquired by training and the principles are quite simple & direct

- Unfortunately, even SS can not take the error rate down to zero

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The Four Facets of Six sigma:

1- Error Prevention

2- Problem Detection

3- Problem Solving

4- Change Management

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Business Theories :

- Murphy's Law :

  Anything that can go wrong will go wrong
- Parkinson's Law :

  Work expands to fill the time available
- Peter Principle :

  Managers are promoted to their level of incompetence

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Errors in Healthcare

1- Administrative errors in admission & Discharge

2- Incorrect or untimely diagnosis

3-Medication errors

4-Error in financial statement

5- Patient Falls

6- Nurses work overload

7- Errors in take-home instructions or medications

……..etc

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History of Six Sigma

By 1990; Motorola instituted the first Six Sigma program. Other major companies, most notably GE, IBM, and Texas Instruments, followed. Then, the Japanese company Sony

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Six Sigma

- It is a disciplined, data-driven methodology focused on eliminating defects.
- Six Sigma is a reference to a statistical measuring system, equivalent to just 3.4 defects per every million opportunities

(Snee, 2003).

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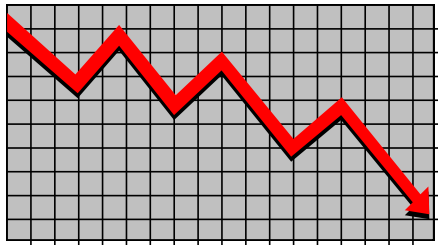
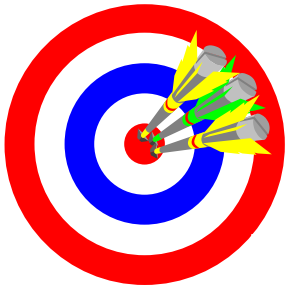
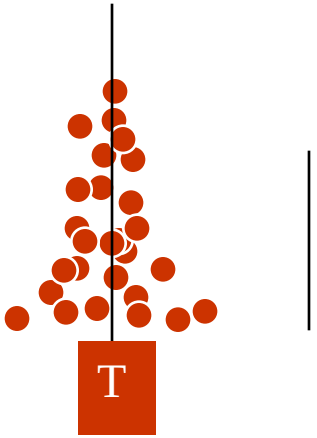
What Is Six Sigma?

- Know What's Important to the Customer (CTQ)
- Reduce Defects (DPMO)
- Centre Around Target (Mean)
- Reduce Variation (Standard Deviation)

Process Philosophy







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SS Process Philosophy

4.Reduce Variation (SD)

3.Centre Around Target (Mean)

1.Know CTQ

2.Reduce Defects

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Calculating sigma level

DPU = Number of **Defects** / Total Number of Product Units

DPO = no. of defects **/ (**no. of units **X** no. of **opportunities for defect per unit)**

DPMO = DPO x 1,000,000

Defects per Million Opportunities *or DPMO* can be then converted to sigma level

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Number of Units (Values)	1000
opportunities for defect per unit	**5**
Number of **Defects**	**4**
DPU (Defect Per Unit)	=Number of **Defects** / Total Number of Product Units **4/1000= 1/250**
DPO (Defect Per opportunity)	**=no. of defects / (no. of units / no. of opportunities for defect per unit)** **1 / 250 X 1/5 = 1/1250**
DPMO = DPO x 1,000,000 **(Defects per Million Opportunities)**	**= DPO x 1,000,000** **1/1250 X 1,000,000 = 800**

DPMO can be then converted to sigma level from the coming table

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Sigma Level

DPMO	Sigma Level	DPMO	Sigma Level	DPMO	Sigma Level	DPMO	Sigma Level	DPMO	Sigma Level
3.4	6	330	4.91	10700	3.8	115000	2.7	460000	1.6
5	5.92	480	4.8	13900	3.7	135000	2.6	500000	1.5
8	5.81	680	4.7	17800	3.6	158000	2.5	540000	1.4
10	5.76	960	4.6	22700	3.5	184000	2.4	570000	1.32
20	5.61	1350	4.5	28700	3.4	212000	2.3	610000	1.22
30	5.51	1860	4.4	35900	3.3	242000	2.2	650000	1.11
40	5.44	2550	4.3	44600	3.2	274000	2.1	690000	1
70	5.31	3460	4.2	54800	3.1	308000	2	720000	0.92
100	5.22	4660	4.1	66800	3	344000	1.9	750000	0.83
150	5.12	6210	4	80800	2.9	382000	1.8	780000	0.73
230	5	8190	3.9	96800	2.8	420000	1.7	810000	0.62

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ONE PAGE EXERCISE

- Q.1 :

What are the 4 main pillars of six sigma philosophy ?

Q.2 :

- If number of Turn Around Time (TAT) Values = 500
- opportunities for defect per unit = 5
- Number of Defects = 10

Calculate the Sigma Level .

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Six Sigma

- Emphasizes the need to recognize opportunities and eliminate defects as defined by customers
- Recognizes that variation hinders our ability to reliably deliver high-quality services
- Requires data-driven decisions and incorporates a comprehensive set of quality tools under a powerful
- Framework for effective problem solving

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Key Six Sigma Players

Six Sigma is not just an improvement methodology; It's also a deployment model نشر نموذج .

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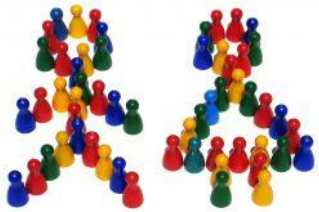
Six Sigma prescribes

at least five roles

that need to be filled and outlines responsibilities for each role:



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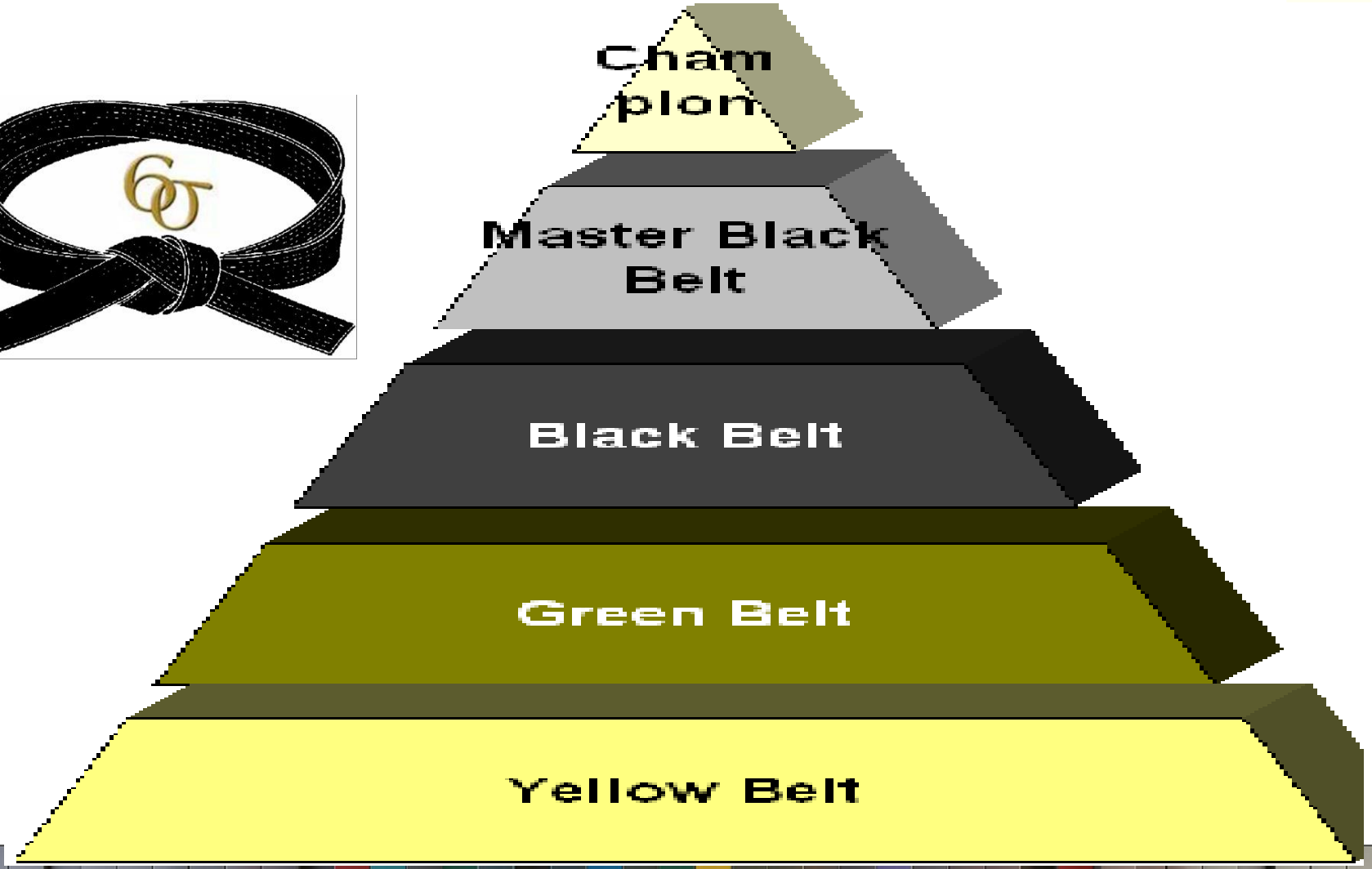
ANATOMY OF SIX SIGMA



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Executive Leaders

The CEO and top executives, who demonstrate their commitment to Six Sigma and promote it throughout the business.

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1- Champions

High-level executives who :

1-Design and oversee the deployment effort and

2-Who provide ongoing support for everyone involved in projects (making sure resources are available, removing obstacles, etc.).

There should be at least one Per company

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2-Master Black Belt (MBB).

The MBB acts as:

- ✓ Trainer, mentor, coach, and guide for the entire organization.
- ✓ Only a small fraction of Black Belts typically become Master Black Belts, so there are fewer even in large companies

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3- Black Belts (BB)

- They are capable of leading projects and doing a lot of improvement work on their own.

- Larger companies often target having ten percent of their staff become “certified” Black Belts and have led a project; they assign them to work full-time on projects.

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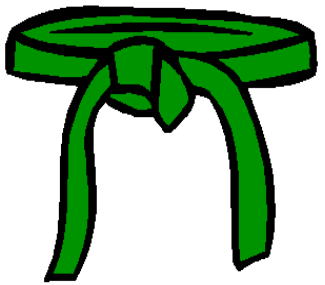
4-Green Belts (GB)

- ✓ Employees who have completed a shortened training program and have a basic awareness of Six Sigma concepts and tools. They are mostly used to staff project teams, working part time on improvement.
- ✓ They rarely lead projects in large companies



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5-Yellow (Orange) Belt

Have attended a quick overview of Six An yellow Belt participates as a core team member and is often responsible for the development of process maps to support Six Sigma projects.

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White Belt

- Can work on local problem-solving teams that support overall projects, but may not be part of a Six Sigma project team.
- Understands basic Six Sigma concepts from an awareness perspective.

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Subject Matter Experts (SME's)

SME's are usually those high professionals that are found within the process or function and are widely known to be the experts of the process or subject matter.

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Elements of successful Deployment

presented in order of importance:-

1- Support and participation of top management;

2- Sufficient resource allocation to improvement teams;

3- Data driven decision making (DDDM) ;

4- Measurement and feed back of key process characteristic .

Without strong management and leadership, the time, effort, and expertise of six sigma project team will be wasted, and results will not be achieved

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Project selection

* Project may be directly linked to strategic goals of the organization .
* GE's Jack Welch considered the best project those that solve customer problems.

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Steps Involved In Six Sigma Project Selection

1-Put the Customer First (VOC).

2-Projects Must Be In Line With Your Business

3-A Good Project Must Be Manageable

4-Every Result Must Be Measurable and Tangible

5-Defining the Desired Outcome

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Rearrange the steps involved In Six Sigma Project Selection :

1- Defining the Desired Outcome

2- A Good Project Must Be Manageable

3- Every Result Must Be Measurable and Tangible

4- Projects Must Be In Line With Your Business

5- Put the Customer First (VOC).

1.

2.

3.

4.

5.

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- ✓ **A successful Six Sigma project also provides a real learning experience.**
- ✓ **To sum it up, a good project will fit the ;**

SMART CRITERIA

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A Bad Project

- ✓ The overall impact is slight
- ✓ The effort required is either minimal or excessive
- ✓ It is unlikely to succeed because it lacks focus, a manageable time frame, or does not have support from organizational leaders

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some examples of bad projects

- Fix an entire operational function
- Fixing a project with no benefit to the business
- Working on processes that are becoming obsolete
- Projects with long-term (>3 years) benefits, and no short-term benefits

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Standard Deviation

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Standard Deviation(SD)

- It is a standard measure of a proportion of variability such that,
- ✓ In a normal distribution, 68% of the values will fall within ± 1 SDs of the mean
- ✓ 95% of the values will fall within ± 2 SDs of the mean, and
- ✓ 99.7% of the values will fall within ± 3 SDs of the mean.

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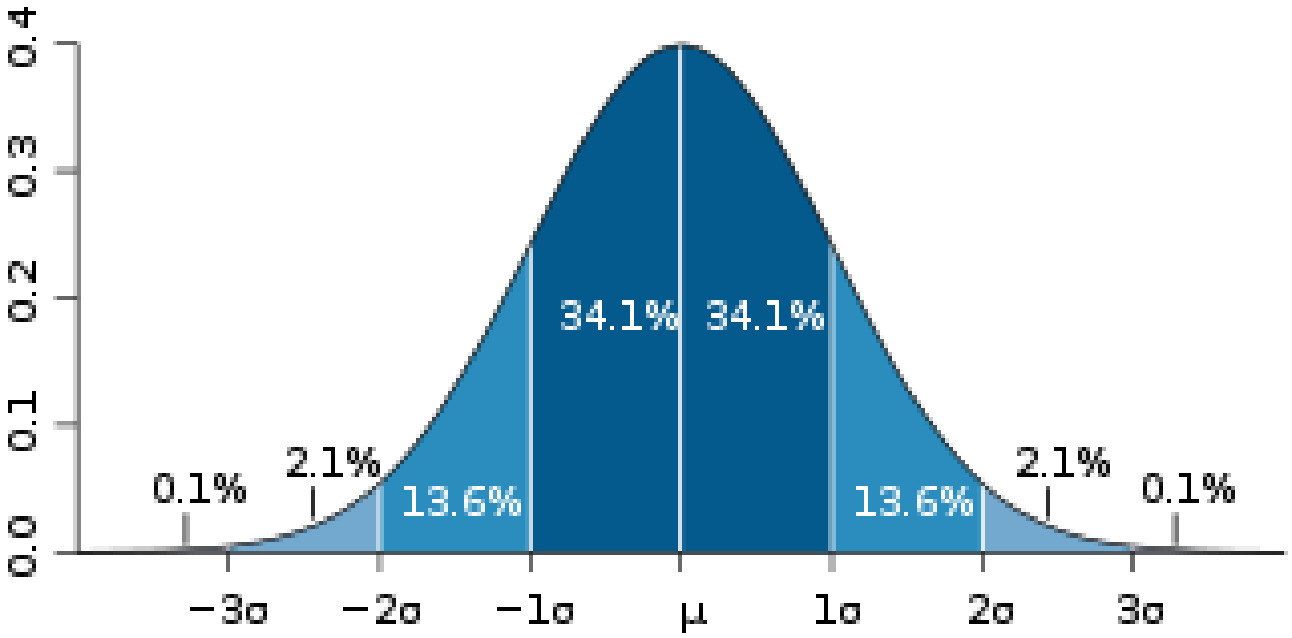
In statistics, **standard deviation** is **a simple measure of the variability or dispersion of a data set.**



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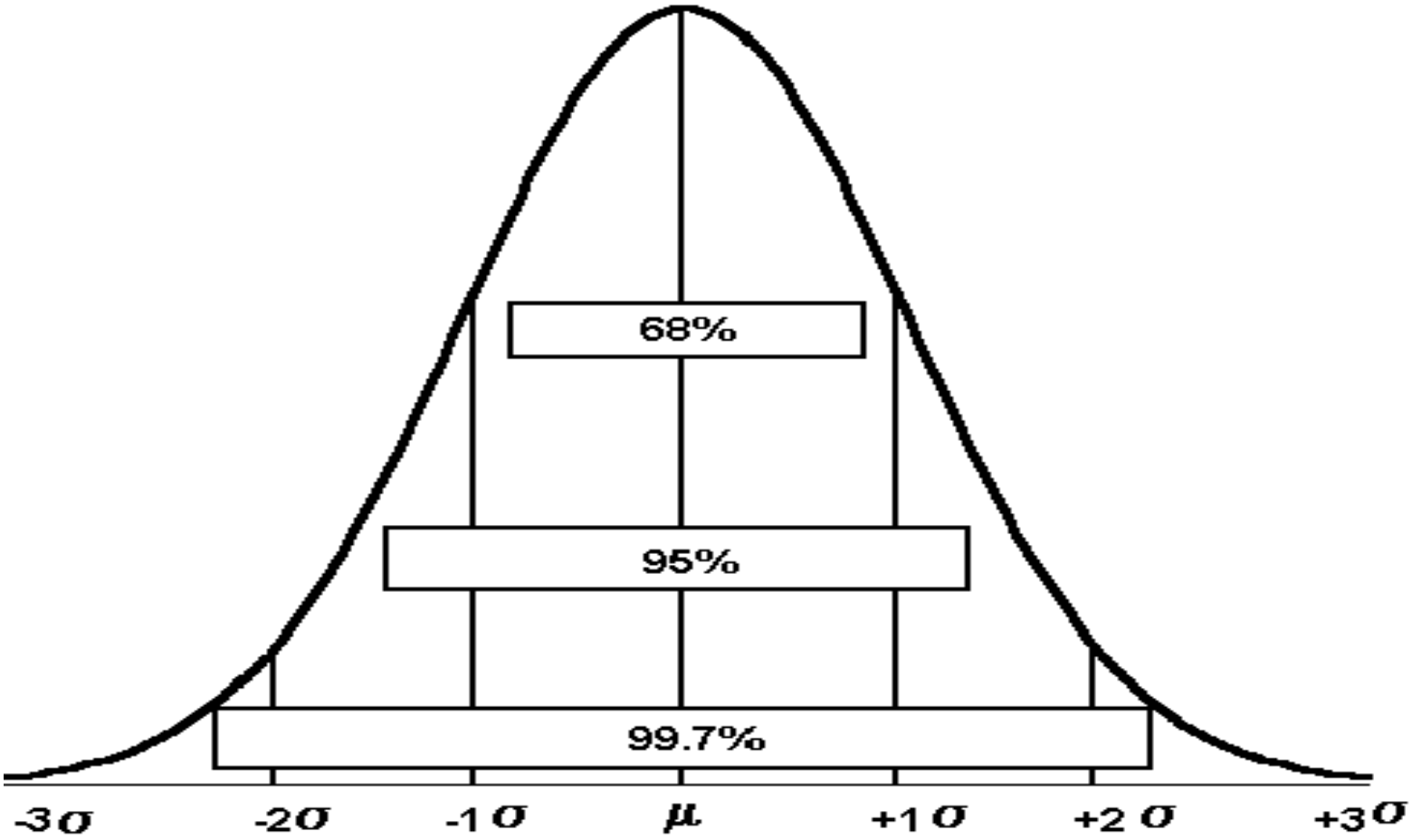
Normal Distribution Curve



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Two classes took a recent quiz. There were 10 students in each class, and each class had an average score of 81.5

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Since the averages are the same, can we assume that the students in both classes all did pretty much the same on the exam?

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The answer is… No.

The average (mean) **does not** tell us anything about the distribution or variation in the grades.

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Here are Dot-Plots of the grades in each class:

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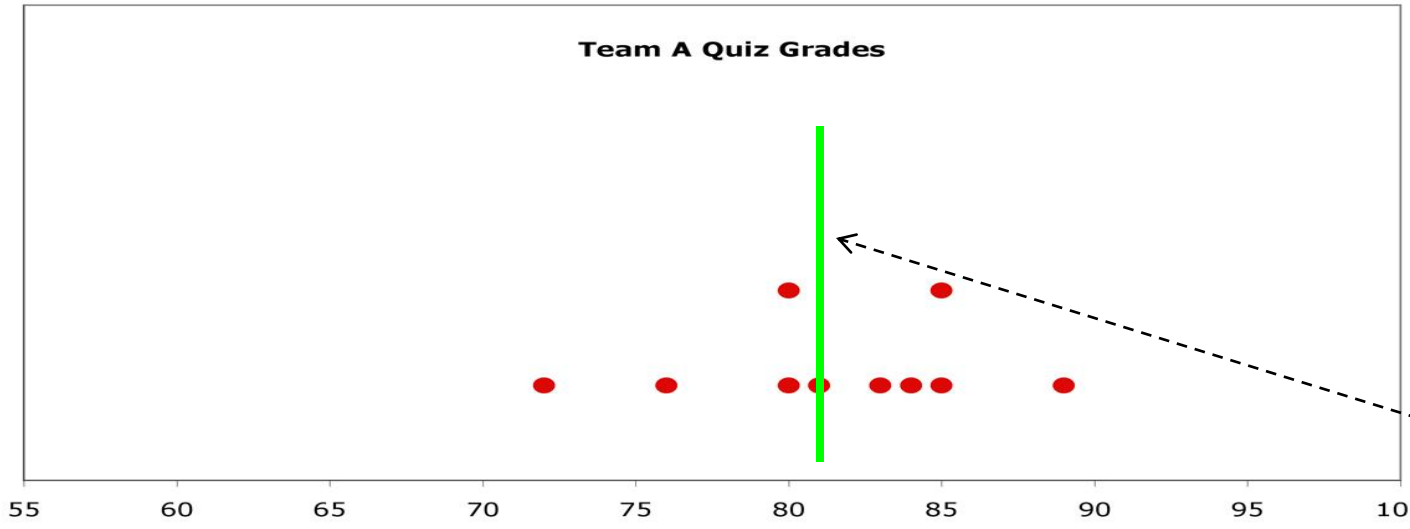
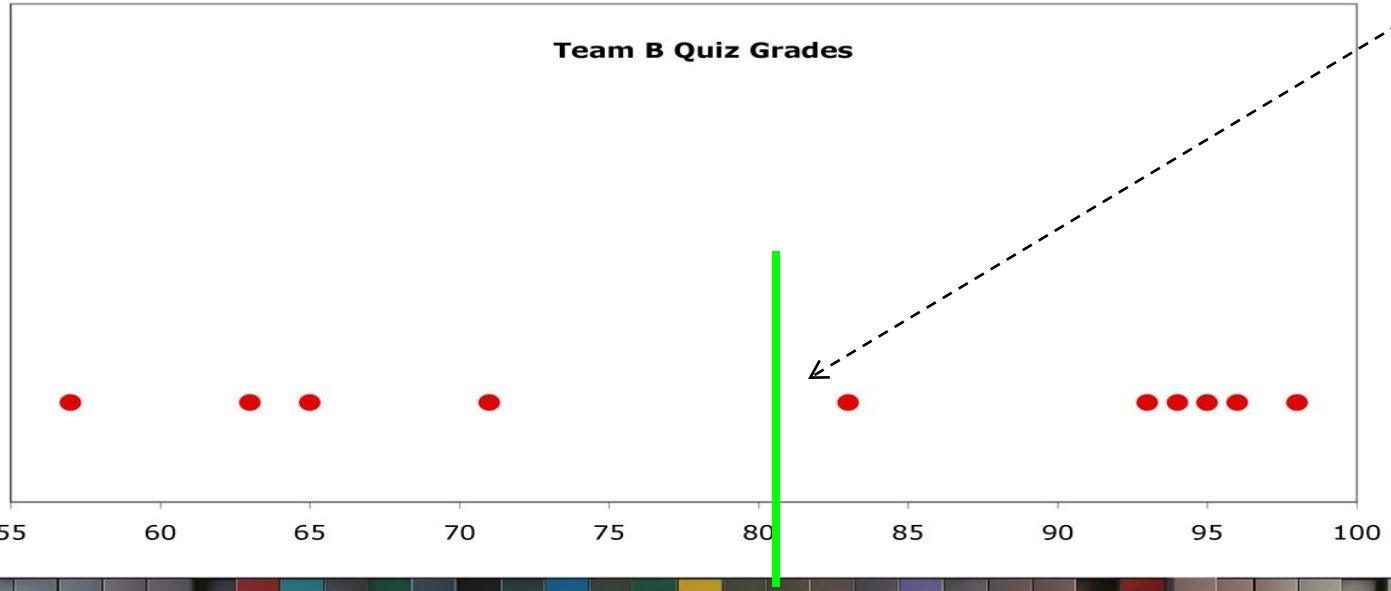


Mean



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So, we need to come up with some way of measuring not just the average, but also the spread of the distribution of our data.

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Why not just give an average and the range of data (the highest and lowest values) to describe the distribution of the data?

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Well, for example, lets say from a set of data, the average is 17.95 and the range is 23.

But what if the data looked like this:

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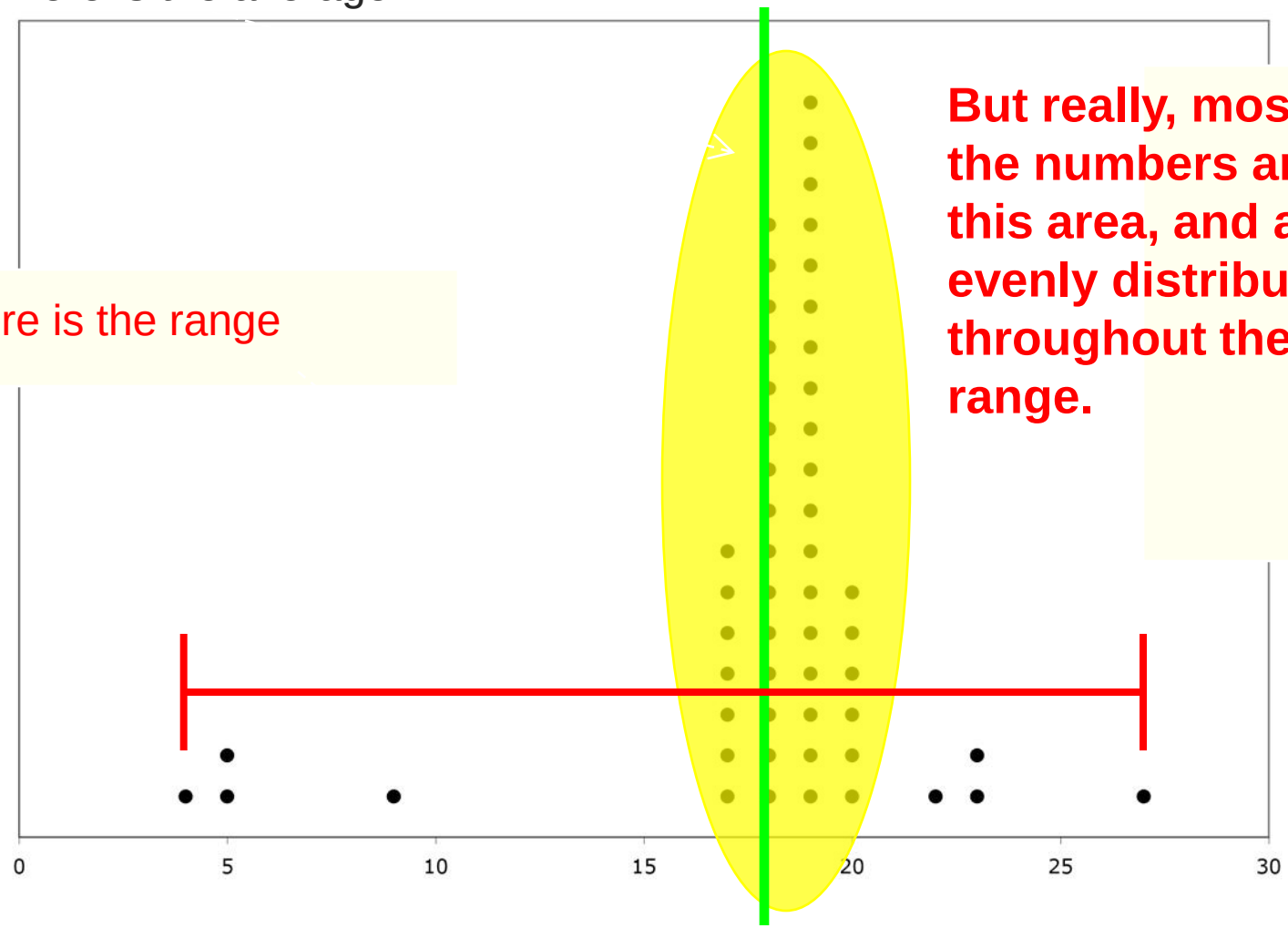
Here is the average



And here is the range

But really, most of the numbers are in this area, and are not evenly distributed throughout the range.

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The Standard Deviation is a number that measures how far away each number in a set of data is from their mean.

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If the Standard Deviation is **large,** it means the numbers **are spread out from their mean.**

If the Standard Deviation is **small,** it means the numbers are **close to their mean.**

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Here are the scores on the math quiz for Team A:

72
76
80
80
81
83
84
85
85
89

Average: 81.5

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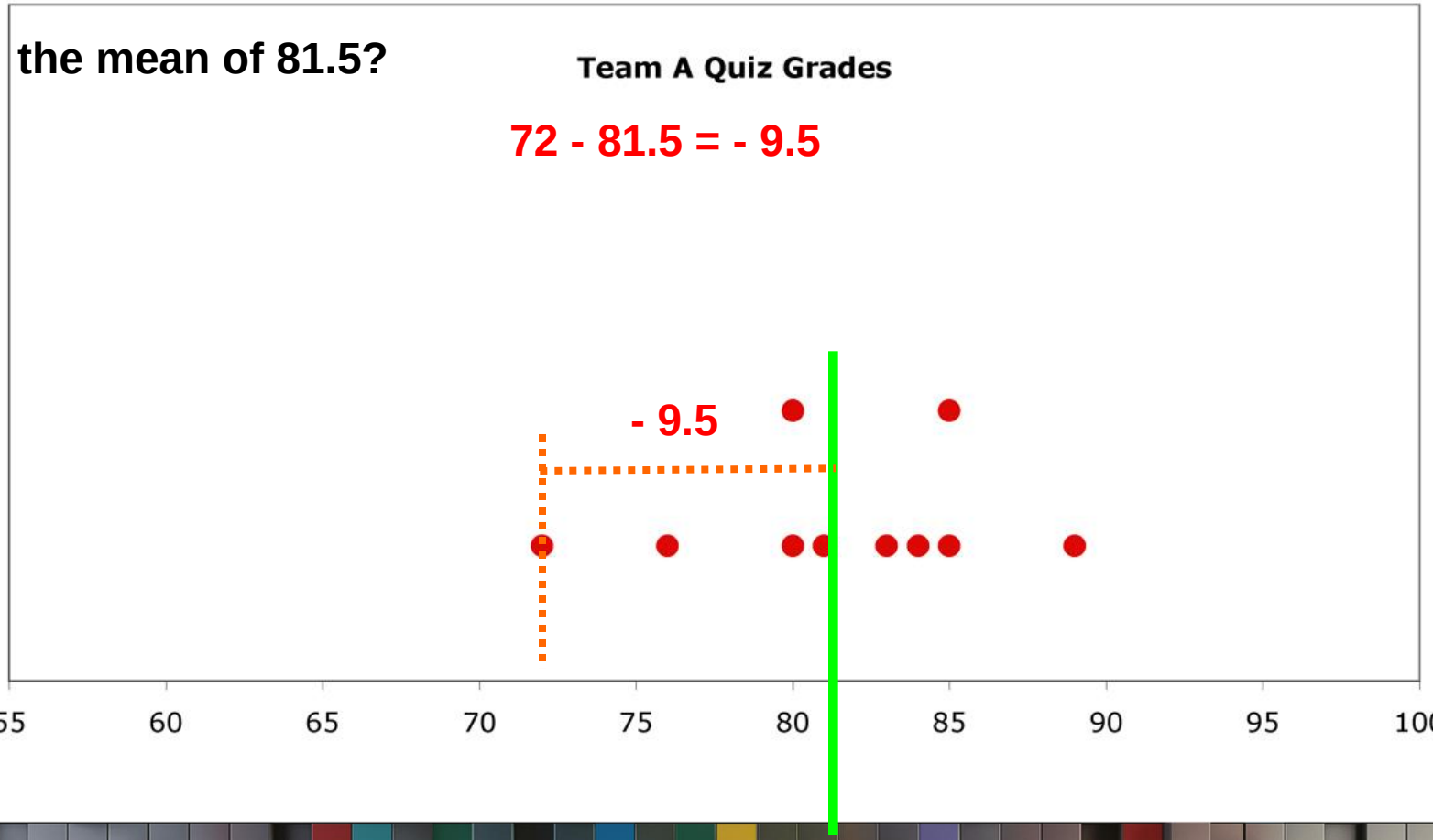
The Standard Deviation measures how far away each number in a set of data is from their mean.

For example, start with the lowest score, 72. How far away is 72 from the mean of 81.5?



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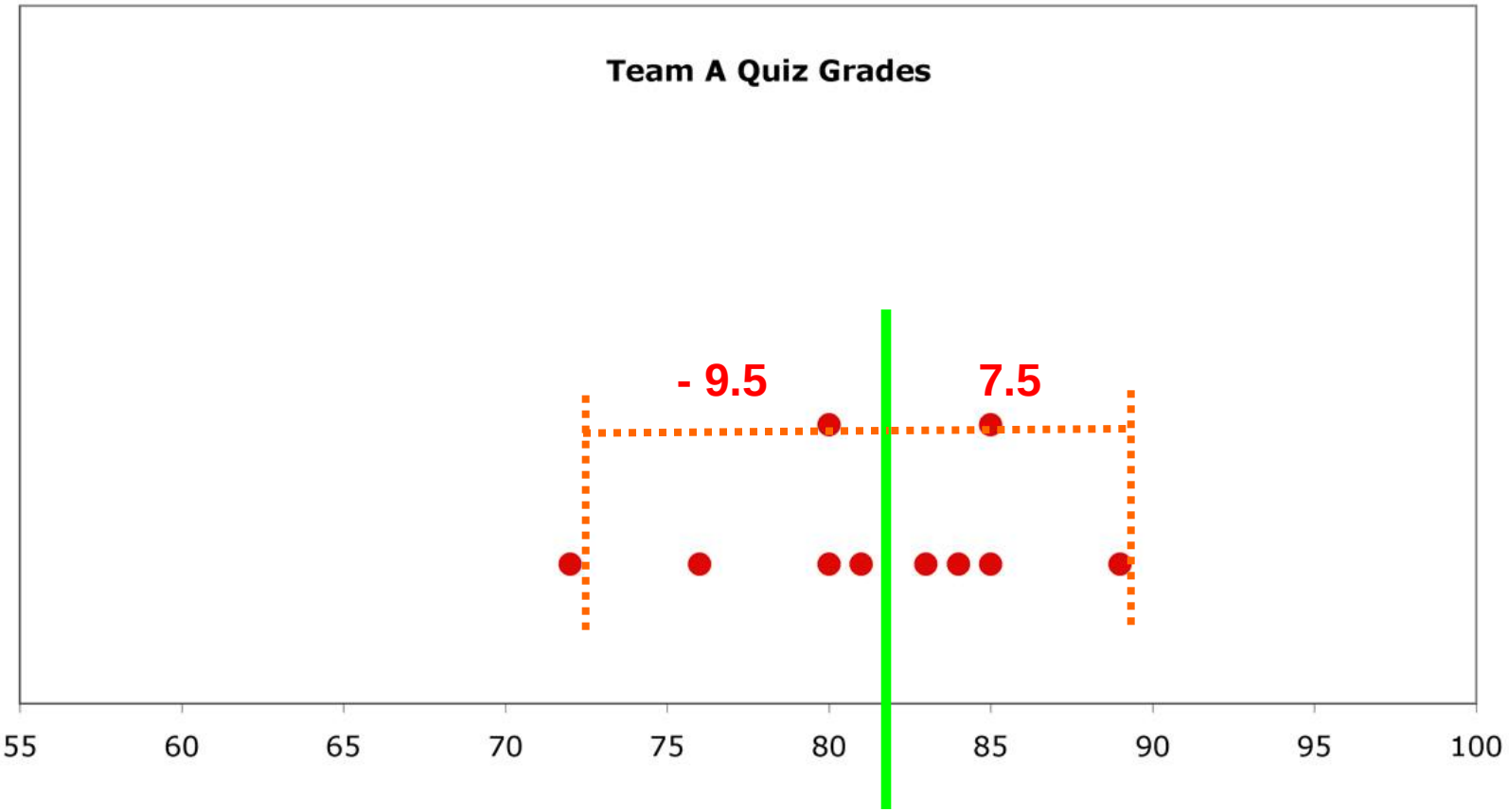
Or, start with the lowest score, 89. How far away is 89 from the mean of 81.5?

89 - 81.5 = 7.5



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Distance from Mean

So, the first step to finding the Standard Deviation is to find all the distances from the mean.

72	-9.5
76	
80	
80	
81	
83	
84	
85	
85	
89	7.5

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Distance from Mean

So, the first step to finding the Standard Deviation is to find all the distances from the mean.

72	- 9.5
76	- 5.5
80	- 1.5
80	- 1.5
81	- 0.5
83	1.5
84	2.5
85	3.5
85	3.5
89	7.5

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Next, you need to square each of the distances to turn them all into positive numbers

	Distance from Mean	
72	- 9.5	90.25
76	- 5.5	30.25
80	- 1.5	
80	- 1.5	
81	- 0.5	
83	1.5	
84	2.5	
85	3.5	
85	3.5	
89	7.5	

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Variance

Next, you need to square each of the distances **to turn them all into positive numbers**

	Distance from Mean	Variance
72	- 9.5	***90.25***
76	- 5.5	*30.25*
80	- 1.5	*2.25*
80	- 1.5	*2.25*
81	- 0.5	*0.25*
83	1.5	*2.25*
84	2.5	*6.25*
85	3.5	*12.25*
85	3.5	*12.25*
89	7.5	***56.25***

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Variance

Add up all of the distances

	Distance from Mean	Variance
72	**- 9.5**	90.25
76	**- 5.5**	30.25
80	**- 1.5**	2.25
80	**- 1.5**	2.25
81	**- 0.5**	0.25
83	**1.5**	2.25
84	**2.5**	6.25
85	**3.5**	12.25
85	**3.5**	12.25
89	**7.5**	56.25

Sum: 214.5

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Variance

Divide by (n - 1) where *n* represents the amount of numbers you have.

	Distance from Mean	
72	- 9.5	90.25
76	- 5.5	30.25
80	- 1.5	2.25
80	- 1.5	2.25
81	- 0.5	0.25
83	1.5	2.25
84	2.5	6.25
85	3.5	12.25
85	3.5	12.25
89	7.5	56.25

Sum: 214.5

(10 - 1)

23.8

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Variance

Finally, take the Square Root of the average distance

	Distance from Mean	
72	- 9.5	90.25
76	- 5.5	30.25
80	- 1.5	2.25
80	- 1.5	2.25
81	- 0.5	0.25
83	1.5	2.25
84	2.5	6.25
85	3.5	12.25
85	3.5	12.25
89	7.5	56.25

Sum: 214.5

---

10 - 1)

= 23.8

= 4.88

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This is the Standard Deviation

	Distance from Mean	Variance
72	- 9.5	90.25
76	- 5.5	30.25
80	- 1.5	2.25
80	- 1.5	2.25
81	- 0.5	0.25
83	1.5	2.25
84	2.5	6.25
85	3.5	12.25
85	3.5	12.25
89	7.5	56.25

Sum: 214.5

(10 - 1)

= 23.8

↓

Its Square Root

= 4.88

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Now find the **Standard Deviation** for the other class

Variance

	Distance from Mean	
57	- 24.5	600.25
65	- 16.5	272.25
83	1.5	2.25
94	12.5	156.25
95	13.5	182.25
96	14.5	210.25
98	16.5	272.25
93	11.5	132.25
71	- 10.5	110.25
63	-18.5	342.25

Sum: 2280.5

(10 - 1)

= 253.4

Its Square Root

= 15.91

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Now, lets compare the two classes again

	Team A	Team B
Average on the Quiz	81.5	81.5
Standard Deviation	**4.88**	**15.91**

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How To Calculate Standard Deviation(SD)

- Standard Deviation is the square root of a measure called the variance.
- Before the SD can be determined, the mean (M) is found;
- Then the deviation, or distance, each score (X) is from M must be calculated.

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How To Calculate Standard Deviation(SD)

- Each deviation ("x") is obtained by subtracting M from each score
- ("x" = X - M). A low "x" means little deviation. A high "x" means more dispersion or variance.
- The variance (SD2) is found by squaring each "x", then finding their sum and dividing by the total number of scores (N).

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All control charts have three basic components

- A centerline, usually the mathematical average of all the samples plotted.
- Upper and lower statistical control limits that define the constraints of common cause variations.
- Performance data plotted over time.

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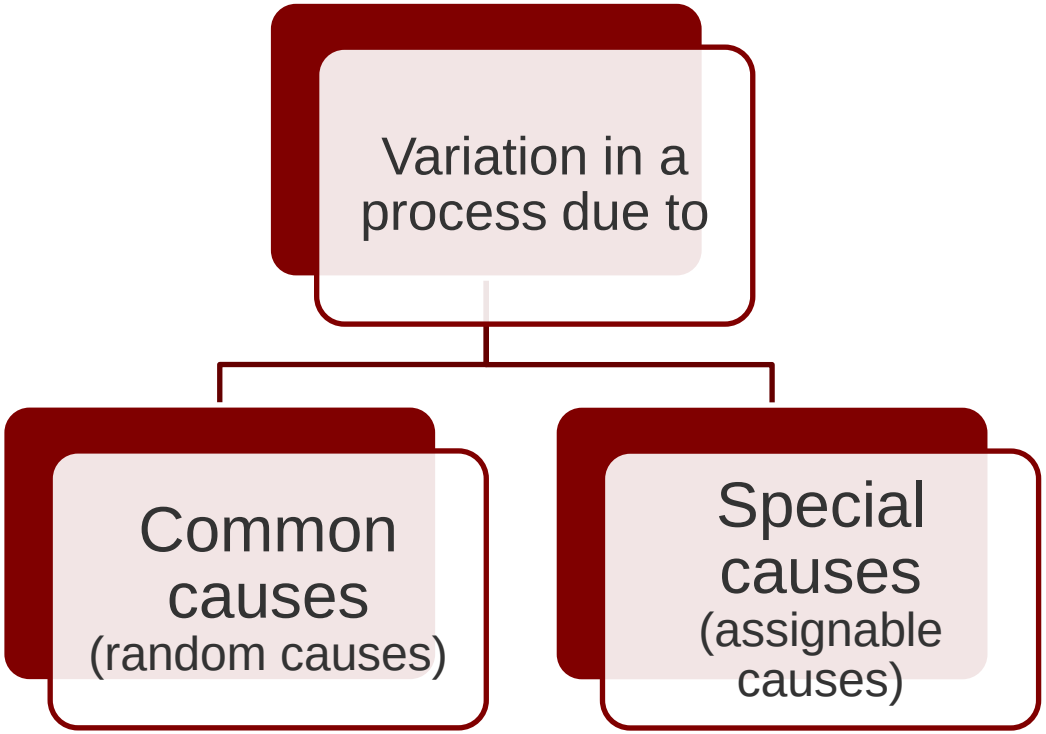
Causes of variation

Shewart, whilst working for Bell telephone Lab., recognize that a process can contain 2 types of variation



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Common cause variation

- Inherent in the design of the process
- Predictable
- Random
- Un-assignable
- Stable
- Due to regular, natural or ordinary causes.

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Special cause variation

- Not inherent in the design of the process
- Not predictable
- Non random
- Assignable
- Unstable
- Due to irregular or unnatural causes.

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Sources of variation

- Man
- Materials
- Machines
- Methods
- Measurements

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formal assignment 4

- Compare :

- ✓ DMAIC
- ✓ DMADV
- ✓ Lean Six Sigma
- ✓ Each participant to bring coming session a hard copy

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Informal assignment 7
(to be sent by MAIL ONLY+ Individual)

- Write about :

- ✓ Healthcare Error Prevention (Poke Yoke)
- ✓ Kanban
- ✓ Hospital Bottleneck problems

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